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(54) Title: LUMINESCENT MATERIAL

(57) Abstract

The invention relates to a luminescent material of the general formula $(Ba_xSr_{1-x-y}Pb_y)_2Mg(BO_3)_2$, wherein $0 \leq x \leq 0.999$ et $0.0005 \leq y \leq 0.05$. Luminescent materials of this general formula are very suitable for use in low pressure mercury discharge lamps for tanning purposes. The invention also relates to a method for preparing this luminescent material.

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Luminescent Material.

The invention relates to a luminescent material, a luminescent screen and a low pressure mercury lamp comprising such a luminescent screen. The invention also relates to a method for preparing the luminescent material.

In US 4,703,224 a low pressure mercury discharge lamp for tanning purposes is disclosed comprising a luminescent screen containing, in addition to a UV-B phosphor, $Sr_2P_2O_7:Eu^{2+}$ and $Ba_2P_2O_7:Eu^{2+}$ as UV-A phosphors. This composition of the luminescent screen allowed the low pressure mercury discharge lamp (further also called lamp) to simulate the spectrum of the sun in the UV-region. A disadvantage of the used luminescent materials, however, is the fact that they both absorb radiation with a wavelength between 280 nm and 350 nm relatively strongly. As a result the short-wavelength radiation generated by the luminescent screen is to a relatively large extent reabsorbed and converted into long-wavelength radiation. The amount of short-wavelength radiation reabsorbed by the luminescent screen is a very strong function of its thickness. For this reason thickness-variations in the luminescent screen along the lamp vessel of the lamp cause relatively large differences between the spectra of the light emitted from different places on the surface of the lamp vessel.

The invention aims to provide a luminescent material mainly emitting in the UV-A region of the spectrum that has a low absorption of short-wave radiation and is therefore very suitable for use in the luminescent screen of a low pressure mercury discharge lamp for tanning purposes.

A luminescent material according to the invention is of general formula

$$(Ba_xSr_{1-x-y}Pb_y)_2Mg(BO_3)_2$$

wherein $0 \leq x \leq 0.999$, $0.0005 \leq y \leq 0.05$.

It has been found that a luminescent material according to the invention has its main emission between 370 nm and 390 nm and absorbs only a relatively small amount of radiation between 280 nm and 350 nm. In case the Sr content of the luminescent material according to the invention is increased, the maximum of the emission band is shifted to a shorter wavelength which results in a smaller amount of absorption of radiation between 280 nm and 350 nm. Table 1 shows the emission maximum EM, the full width at half maximum FWHM and the absorption coefficient AQ_{254} of a luminescent material according to the invention for different values of x when $y = 0.005$. Table 2 shows the emission maximum EM, the full width at half maximum FWHM, the absorption coefficient AQ_{254} and the quantum efficiency QE for different values of y of a luminescent material according to the invention for different values of y when the luminescent material contains no Sr.

It has also been found that a close simulation of the UV-spectrum of sunlight can be obtained for low pressure mercury discharge lamps with a luminescent screen that comprises, apart from a luminescent material according to the invention, for instance lanthanum phosphate activated with cerium and barium silicate activated with lead.

A luminescent material according to the invention can be prepared by means of a method comprising the following steps:

- mixing of $BaCO_3$, $SrCO_3$, MgO, H_3BO_3 and PbO,
- heating the obtained mixture in an oxygen containing atmosphere, and
- grinding the resulting material. Preferably the last two steps of the method are repeated. It has been found that good results are obtained in case the heating is done at 900 C.

In a typical example a luminescent material not containing Sr was prepared by mixing $BaCO_3$, MgO, H_3BO_3 and PbO in an agate mortar. The mixture was subsequently heated in an oxygen containing atmosphere, and ground. The last two steps of this preparation method were repeated and the resulting luminescent material was stored in a dry container.

TABLE 1

x	EM(nm)	FWHM(nm)	AQ_{254}(%)
1.0	380	53	83
0.75	375	59	94
0.5	362	62	93
0.25	346	77	88
0.0	340	57	85

TABLE 2

y	EM(nm)	FWHM(nm)	QE(%)	AQ_{254}(%)
0.005	380	53	63	80
0.01	380	53	60	83
0.02	380	53	50	90

CLAIMS:

1. Luminescent material of general formula

$$(Ba_xSr_{1-x-y}Pb_y)_2Mg(BO_3)_2$$

wherein $0 \leq x \leq 0.999$, $0.0005 \leq y \leq 0.05$.

2. Luminescent screen comprising a bearer provided with a luminescent material, characterized in that the luminescent screen comprises a luminescent material as claimed in claim 1.

3. Low pressure mercury discharge lamp provided wit a luminescent screen as claimed in claim 2.

4. Method for preparing a luminescent material as claimed in claims 1-5, comprising the following steps:

- mixing of $BaCO_3$, $SrCO_3$, MgO, H_3BO_3 and PbO,
- heating the obtained mixture in an oxygen containing atmosphere, and
- grinding the resulting material.

5. Method according to claim 4, wherein the last two steps of the method are repeated.

6. Method according to claim 4 or 5, wherein the heating is done at 900 C.

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC6: C09K 11/66
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: C09K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4703224 A (KENDRICK D. RATTRAY ET AL), 27 October 1987 (27.10.87) -- --------	1-6

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4703224 A	27/10/87	CA 1263688 A	05/12/89
		EP 0188211 A,B	23/07/86
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